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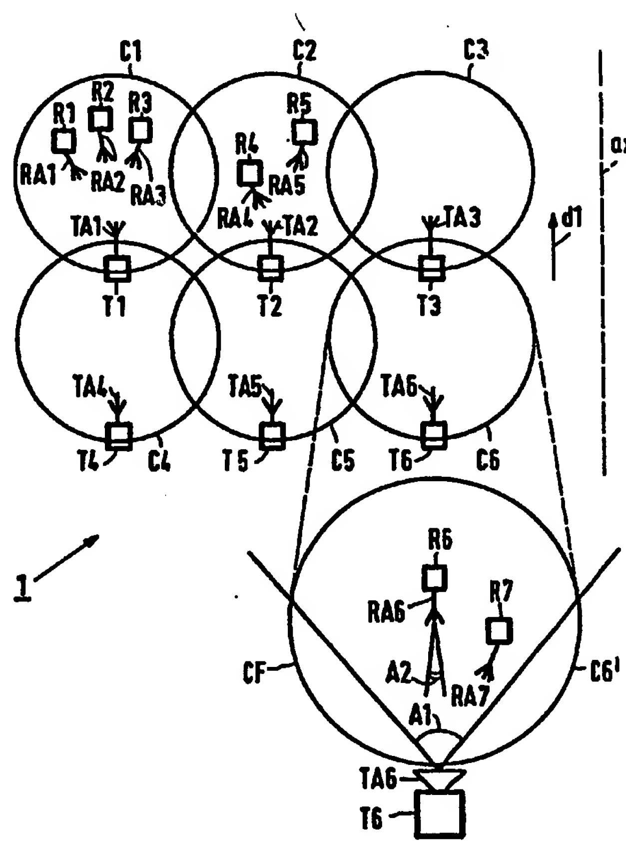
(57) Abstract

Known is a low-power point-to-multipoint cellular television transmission system (1) in which transmitter stations (T1, ..., T19), which are located in centres of cells (C1, ..., C19) of the system (1), comprise omni or quadrant-directional transmitting antennas transmitting to receiver stations (R1, ..., R8) located in the cells. The known system operates in the microwave band. Such a system architecture gives either rise to a transmitting antenna which is difficult to manufacture or in itself is rather complex and thus relatively expensive. A system architecture is provided which can be easily implemented and which avoids using omni directional antennas. To this end the transmitter stations (T1, ..., T19) are located at the circumference (CF) of their cells (C1, ..., C19) of the cellular sytem (1), and each transmitter station is provided with a directional antenna (TA1, ..., TA7) covering its cell. Preferably, the transmitting antennas (TA1, ..., TA7) in the system generally transmit along a main geographical axis (ax) of the system (1). Each program to be transmitted can be transmitted via a separate channel and a separate radiator (TA1a, TA1b, ..., TA1i). Then, the channels are completely independent to each other.



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"Point-to-multipoint cellular television transmission system"

The present invention relates to a point-to-multipoint cellular television transmission system including at least two cells, each provided with a relatively low-power transmitter station for cell-wise transmission of at least one television signal in a cell of the cellular system in which cells are adjacent to at least one other cell of the cellular system, and in which the transmitter stations transmit, at least in part, the same television signals in a microwave band, the system further including a plurality of receiver stations comprising a directional receiving antenna for receiving a television signal from one of the transmitter stations.

A point-to-multipoint cellular television transmission system of this kind is known from the European Patent Application No. 0 282 347. Herein, a cellular television system is described wherein transmitter stations are located in centres of cells of an array of cells. In order to cover complete cells, the transmitters are provided with an omnidirectional transmitting antenna, e.g. implemented by a small number of quadrant directional radiators. A multiplexed signal is modulated onto a single microwave carrier, so as to allow for a wide variety of signal formats to be combined efficiently. Such signals can be FM (Frequency Modulation) video signals with audio subcarriers, digital signals, or the like. The system is arranged for two-way communication services including television, both for public and private programming, digital two way transmission, video teleconferencing, radio programming, telephone services, or the like, simultaneous communication services being possible because of the broad bandwidth available in the applied 27.5 to 29.5 GHz microwave band. The system applies relatively low-power transmitters so as to allow for frequency reuse in a given geographical area. In the disclosed microwave band it is extremely difficult to manufacture a usable omni-directional antenna. In fact, omnidirectional broadcasting is achieved by applying a small number of quadrant directional radiators so as to achieve space displacement of multiple ring locations of the transmitter stations, such as disclosed in Fig. 4A, and on page 6, lines 50-52, page 7, lines 9-10, and page 8, lines 61-63 of said European Patent Application No. 0 282 347. The use of quadrant directional

radiators, however, gives rise to a relatively complex, and herewith relatively expensive transmitter station, because of the fact that phase coherent radiation by the various radiators is required. Also, applying multiplexing and demultiplexing of a large number of signals is a complicating factor.

It is an object of the present invention to provide a point-to-multipoint cellular television transmission system of the above kind not having the drawbacks of said known system, which can be easily implemented, and which can be easily extended.

To this end the point-to-multipoint cellular television transmission system according to the present invention is characterized in that each transmitter station is located at a circumference of its cell of the cellular system, and is provided with one directional transmitting antenna for substantially radiating at least one television signal into its cell. Due to the fact that no phase inter-relationship has to exist between various channels to be transmitted, inter alia, a very simple system architecture is achieved.

In an embodiment of a point-to-multipoint cellular television transmission system according to the present invention, the transmitting antennas generally transmit along a main geographical axis of the system. Herewith, interference between transmitting stations is reduced as to the application of omni-directional transmitting stations.

In another embodiment of a point-to-multipoint cellular television transmission system according to the present invention, the system comprises two sub-systems, in each of which the transmitting antennas generally transmit along a geographical axis, the axes being non-coinciding. Herewith, the system can more easily be adapted to various terrain conditions.

In an embodiment of a point-to-multipoint cellular television transmission system according to the present invention, the transmitter stations comprise a plurality of independently operating transmitters each transmitting on a different, relatively narrowband, channel, the transmitters each being coupled to a radiator. Herewith, there is no logical inter-relationship between the channels of the the system whatsoever. The system can thus be expanded very easily, just by adding transmitters and radiators, as long as band width is available.

In an embodiment of a point-to-multipoint cellular television transmission system according to the present invention, the radiators per transmitter station are directed into substantially the same direction. Herewith, all receiver stations in a cell receive the same

set of channels. In the alternative, with many channels, some program diversity could be achieved in a cell by directing radiators of groups of channels to different sectors of the cell. Then, the beamwidth of the radiators should be such that only a part of the cell is covered herewith.

In an embodiment of a point-to-multipoint cellular television transmission system according to the present invention, large signal shadows in the system are covered by auxiliary transmitter stations, which are coupled to a main transmitter station in a cell. Such large signal shadows can be caused by terrain conditions, such as a hilly terrain. The auxiliary transmitter station can be coupled to the main transmitter station by wire or by wireless link. In given terrain circumstances, such reflective areas at large objects, such an auxiliary transmitter station can be dispensed with.

In an embodiment of a point-to-multipoint cellular television transmission system according to the present invention, small signal shadows in the system are covered by cabling from a receiver station, which is shared by a plurality of subscribers. Such small signal shadows can be caused by large buildings. Then, the receiver station can be put on top of the large building. Herewith, the overall serviceability of the cellular system is improved.

Further embodiments are claimed in the dependent claims, and relate to improved system performance. This improved system performance can be achieved by applying signal compression methods such as MPEG (Moving Picture Expert Group), by applying polarization diversity throughout the array of cells, by interleaving channels groups assigned to particular frequency sets, or by applying polarization diversity within a cell. For a good overall coverage of the cells of the system, the cells may partly overlap each other. The microwave band used by the system may be 40.5 to 42.5 GHz for the so-called CEPT (Conference of European Posts and Telecommunications Administations) countries, may be 27.5 to 29.5 GHz for other countries, or may be another microwave band when other frequencies are made available by the Authorities. The transmitting antennas can be directed in such an angle with respect to a terrestial ground level in a propagation direction of a radiated beam that in a straight line the beam touches the ground level at a predetermined distance, preferably between 5 and 6 kilometers from the transmitter station, it being achieved that a transmitting range is limited so that a better frequency re-use is possible. The transmitter stations can partly be provided with public programs or with private programs, i.e. the program packages and services provided by the transmitting stations may vary per cell. The transmitter stations may be provided with programs and services via landlines, via satellites, via wireless links, or by any other means. When (two-way) services are provided,

billing of these services can be done at a central site. With two-way services, a return channel to the transmitting station can be a public telephone line, or can be a Telepoint line from a cellular radio system, or the like. Apart from television signals, a considerable number of audio signals or data signals can be assembled with the television signals on one or more auxiliary carriers. Preferably, an aperture angle of the transmitting antenna can be between 50 and 70 degrees, thus giving rise to a good coverage area. A practical angle of 64 degrees has been proven to be a good choice.

The receiver stations may be fixed stations, or may be mobile stations. In the latter case, the receiver stations constantly keep their directional antennas pointing to a transmitter station.

The present invention will now be described, by way of example, with reference to the accompanying drawings, wherein

Fig. 1 schematically shows a point-to-multipoint cellular television transmission system according to the present invention,

Fig. 2 schematically shows geographical details in a cell of a point-to-multipoint cellular television system according to the present invention,

Fig. 3 shows positioning of transmitter stations in a first cell configuration according to the present invention,

Fig. 4 shows positioning of transmitter stations in a second cell configuration according to the present invention,

Fig. 5 shows positioning of radiators in a transmitter station casing according to the present invention,

Fig. 6 shows an electrical diagram of a transmitter station according to the present invention,

Fig. 7 shows a part of an IF-exciter according to the present invention,

Fig. 8 shows an electrical diagram of a signal combining part in a transmitter station according to the present invention,

Fig. 9 shows an electrical diagram of a receiver station in a point-to-multipoint cellular television transmission system according to the present invention, and

Fig. 10 schematically shows an in-house receiver station according to the present invention.

Throughout the figures the same reference numerals are used for the same

features.

Fig. 1 schematically shows a point-to-multipoint cellular television transmission system 1 according to the present invention. The cellular system 1 is configured as a plurality of cells C1, C2, C3, C4, C5, and C6. The cells are adjacent to at least one other cell of the cellular system 1. The cells may have different dimensions. The cell C6 is also shown in an enlarged view, indicated with C6'. The cellular system 1, in which television signals, radio signals, telephone signals, and data signals are transmitted inter alia, either in analog or digital form, includes transmitter stations T1, T2, T3, T4, T5, and T6 which are located at a circumference of the cells C1, C2, C3, C4, C5, and C6, respectively. The transmitter stations T1 to T6 are each provided one transmitting antenna TA1, TA2, TA3, TA4, TA5, and TA6, respectively, which can be a complexity of radiators. For minimizing inter-station interference, preferably the transmitting antennas TA1 to TA6 generally transmit along a main geographical axis ax, in the given example all generally in the same direction d1. The transmitter stations T1 to T6 transmit relatively low-power microwave signals, preferably in the 27.5 to 29.5 GHz range or 40.5 to 42.5 GHz range. The transmitter stations T1 to T6 transmit, at least in part, the same television signals, or other signals. In this respect a cell may cover a community, each community having its own demand. As will be described in the sequel, typically each transmitter station transmits a number of different signals. A part of these signals can be be public television signals, and other signals can be private signals, corresponding to specific services requested by the community. The transmitter stations may be coupled to public transmitter stations by landlines or by other means such as wireless links, for getting public television signals, and may be coupled to service providers to get private signals and services. Such a provision of signals to the transmitter stations T1 to T6 is known per se, and is not shown in detail here. Low-power transmission inter alia distinguishes the system 1 over existing public television broadcasting systems. For a general description of non-cellular prior low-power television systems, referred is to the article "Low-power television - Short-range, low-cost TV stations are in the offing as the FCC prepares to establish broadcast requirements", IEEE spectrum, pp. 54-59, June 1982. The system 1 further includes a plurality of receiver stations R1, R2, R3, R4, and R5, comprising directional antennas RA1, RA2, RA3, RA4, and RA5, respectively, for receiving a television signal from one of the transmitter stations. For a more detailed description of a communication between a transmitter station and a receiver station,

the enlarged cell C6' is shown, which includes receiver stations R6 and R7, having receiving antennas RA6, and RA7, respectively. Typically, there may be thousands of receiver stations in the cell C6', serviced by the transmitter station T6. Typically, the transmitter station T6 may transmit 32 channels in parallel. The transmitter antenna TA6, which is positioned at a circumference CF of the cell C6', covers the cell C6', which typically has a diameter of a few tens of kilometers. To this end the antenna TA6 can be a complexity of 64° horn radiators. In order to obtain a more complete system coverage, the cells C1 to C6 partly overlap each other. The receiver antennas RA6 and RA7, which are antennas with a few degrees antenna aperture, are directed to the transmitter station T6, so as to form a line-of-sight transmission link. Antenna aperture angles A1 and A2 of the antennas TA6 and RA6, respectively, are shown in Fig. 1. Frequence re-use in the cellular system 1 may be based on experimental measurement values in a given geographical area or may be based on estimates using system models, e.g. a model based on protection ratio, a model based on interferer below noise, or a model based on a radio horizon, these models not being shown in detail. A simple model is the radio horizon based model in which the radio horizon is simply determined by the transmit height and the receive height and the curvature of the earth. A protection ratio based model for analogue FM television may be in accordance with a model proposed by Harverson etc al., "Required Protection Ratios for Co-Frequency PAL", Int. Journal of Satellite Communications, Vol. 9, 1991, pp. 381-389, for a 16 MHz/V devition as recommended in MPT 1550, a Standard for Analogue MVDS (Multipoint Video Distribution Systems) operating in the frequency band 40.5 to 42.5 GHz. Harverson et al. give Channel-to-interference ratios for a desired picture grade. For a better interference protection, the 40.5 to 42.5 GHz microwave band may be split in two frequency sets. In addition to alternating horizontal and vertical polarization, either on a cell-by-cell basis or on a channel-by-channel basis within a cell, interleaving of the two frequency sets will then give a better interference protection.

Fig. 2 schematically shows geographical details in the cell C1 of the point-to-multipoint cellular television system 1 according to the present invention. In the cell 1, obstacles may upset line-of-sight communication between the transmitter station T1 and the receiver stations within the cell C1. In the example given, a hill H upsets line-of-sight communication between the transmitter station T1 and the receiver stations R1 and R2, the hill H giving rise to a large signal shadow as to the transmitter station T1. To cover the receiver stations R1 and R2 in the large radio shadow, an auxiliary station in the form of a repeater station RS, which comprises directional antennas RSA1 and RSA2, is positioned on

top of the hill H for relaying signals between the transmitter station T1 and the receiver stations R1 and R2, and vice versa, as the case may be. Alternatively, an additional transmitter station TA7 may be provided for covering the large radio shadow. The transmitter station T7, which covers a sub-cell C1a, transmits in a direction d2 of the main geographical axis ax, opposite to the direction d1. Subscribers S1 and S2 are positioned in a small signal shadow of a high building B. For establishing a communication between the transmitter station T1 and the subscribers S1 and S2, a receiver R8, provided with a directional antenna RA8 directed to the transmitting antenna TA1, is placed in the building B. The radio station R8 is shared by the subscribers S1 and S2 by cabling.

Fig. 3 shows positioning of transmitter stations T8, T9, T10, and T11 in a first cell configuration according to the present invention. The transmitter stations T8 to T11 are located at circumferences of cells C8, C9, C10, C11, and C11a, respectively. With arrows ar8, ar9, ar10, ar11, and ar11a, respectively, main transmitting directions of the transmitter stations are indicated, the transmitter stations T8 and T10 generally transmitting along a first geographical axis ax1 of the system 1, and the transmitter stations T9, T11, and T11a generally transmitting along a second geographical axis ax2 of the system 1. Transmitting antennas of the transmitter stations T8 to T11, and T11a are positioned at suitable locations along the circumference of the cells C8 to C11, i.e. generally on top of high buildings so that a clear line of sight is guaranteed for the majority of subscribers serviced by the transmitter stations. The programs or services offered by the transmitter stations T8 to T11 may vary per transmitter station. Such a configuration can be applied in a hilly terrain ht, in the given example to the right of a coastline cl to the left of which a sea se extends. The positioning of the transmitter stations T8 to T11, and T11a, as described, contributes to interference free reception by the receiving stations covered herewith.

Fig. 4 shows positioning of transmitter stations T12 to T19 in a second cell configuration according to the present invention. The transmitter stations T12 to T19 are located at circumferences of cells C12 to C19, respectively. With arrows ar12 to ar19, respectively, main transmitting directions of the transmitter stations are indicated, the transmitter stations T12, T13, T16, and T17 generally transmitting along the first geographical axis ax1 of the system 1, and the transmitter stations TT14, T15, T18, and T19 generally transmitting along the second geographical axis ax2. Transmitting antennas of the transmitter stations T12 to T19 are positioned at suitable locations along the circumference of the cells C12 to C19, i.e. generally on top of high buildings so that a clear line of sight is guaranteed for the majority of subscribers serviced by the transmitter stations T12 to T19.

The programs or services offered by the transmitter stations T12 to T19 may vary per transmitter station. Such a configuration can be applied in a flat terrain ft. The positioning of the transmitter stations T12 to T19, as described, contributes to interference free reception by the receiving stations covered herewith.

Fig. 5 shows positioning of radiators TA1a, TA1b, ..., TA1i in a transmitter station casing cs according to the present invention, which is placed outdoors. The complexity of radiators TA1a, TA1b, ..., TA1i form the transmitting antenna TA1. A part of the transmitter station's electronics, schematically shown by a box bx, is put into the casing cs. One casing cs may comprise nine transmitting channels, with one radiator per channel. Eight transmitting channels are used simultaneously, whereas a ninth channel is a spare channel which can be used if a channel fails. In the given example, the nine radiators TA1a, TA1b, ..., TA1i are intermittently horizontally and vertically polarized from top to bottom of the casing cs so as to achieve polarization diversity within a cell. This intermittent polarization is achieved by rotationally displacing the radiators with respect to each other by 90° with respect to a fixed constructional feature of the antenna TA1. In Fig. 5, 90° rotation of the radiators with respect to each other is schematically indicated with 90° rotated horn radiators, which have an aperture angle of 64°, so as to cover a cell. With respect to polarization the radiators are adjustably mounted within the casing cs (mechanical adjustment details are not shown in detail, but can be any suitable adjustment means from the mechanical art). The radiators can thus be vertically or horizontally polarized. Also, mechanically, the same radiators can be applied, mounted in the same way, horizontal or vertical polarization being achieved by a different wave guide exciting mode, known per se. In a manner known per se, the radiators can also be circularly polarized, either to the left or to the right. Typically four casings cs are mounted in one transmitter station T1, thus supporting 32 active channels, and 4 spare channels. The antenna TA1 thus typically is formed by a complexity of 36 radiators. In Fig. 5, the radiators TA1a, TA1b, ..., TA1i are all shown to point into the same direction d, for all transmitter casings in the cell. For achieving some kind of program diversity within a cell, radiators of groups of channels may be directed to different sectors of the cell. The radiators then have a smaller aperture angle than 64°.

Fig. 6 shows an electrical diagram of the transmitter stations T1 to T19 according to the present invention, showing electronics distributed over outdoor units as described in Fig. 5 and indoor units coupled to outdoor units by cabling, the transmitter stations T1 to T19 transmitting in the 40.5-42.5 GHz microwave band. Transmission channel

ch1 to chn comprise IF (Intermediate Frequency) exciters IF1 to IFn, n being an integer. The IF-exciters IF1 to IFn provide 1.5-1.83 GHz intermediate signals, to be up-converted to said microwave band. Preferably, the 1.5-1.83 GHz signals are obtained by up conversion in two steps, a first modulation step to 479.75 MHz using modulation means known per se for modulation of video, audio or data signals, 479.75 MHz being an official intermediate frequency in satellite receivers, and a second up conversion step to a 1.5-1.83 GHz wave band in which the transmission channel is adjustable. Frequency adjustment signals fa1 to fan are applied by a system manager unit SMU to the IF-exciters IF1 to IFn so as to completely independently adjust the channels ch1 to chn within said microwave band. The system manager unit SMU can be a personal computer of known type being provided with I/O (input/output) cards for digital and/or analog signals and being coupled to a keyboard/display unit VDU. Various signals to be transmitted are fed to the IF-exciters IF1 to IFn, such as video signals vs1 to vsn, and audio signals as1 to asn, or, alternative data signals. The IF-exciters IF1 to IFn are coupled to 13 GHz up converters UC1 to UCn, respectively, i.e. X-band converters. The up converters UC1 to UCn comprise mixers 601 to 60n, band pass filters 611 to 61n, and amplifiers 621 to 62n. The mixers 601 to 60n are coupled to a 12 GHz synthesizer/nine-way power splitter unit SYNT. The adjustment signals fa1 to fan can be supplied by the system manager unit SMU, can be provided by thumb-wheel switches (not shown), or can be telemetric signals. The up converters UC1 to UCn are coupled to frequency tripler units FTU1 to FTUn, which can be varactor diodes suitable for operating in said 40.5-42.5 GHz wave band. Outputs of the frequency tripler units are coupled to respective radiators TA11 to TA1n, the complexity of radiators TA11 to TA1n forming the transmitting antenna TA1. The system manager unit SMU is programmed to monitor various signals of the channels ch1 to chn, such as signals va1 to van of the varactors FTU1 to FTUn, currents of the amplifiers 621 to 62n, or the like. In this way the system manager unit SMU can determine a defect channel and switch over to a spare channel. The system system manager SMU is further programmed to switch over a given program or signal to be transmitted from one channel to another channel, to switch on/off a transmitting channel, to communicate with local service suppliers or with public program suppliers (not shown) for getting a variety of programs and/or services.

Fig. 7 shows a part of the IF-exciter IF1 according to the present invention, to which said 479.75 MHz signal is fed. The choice of this first intermediate frequency has the advantage that for successive filtering cheap SAW (Surface Acoustic Wave) filters can be applied. Said part comprises an amplifier 71, a SAW-filter 72, an

amplifier 73, a mixer 74, an amplifier 75, and a band pass filter 76 at an output of which said 1.5-1.83 GHz band signal is provided. An input of the mixer 74 is coupled to an frequency adjustable channel synthesizer CSYN.

Fig. 8 shows an electrical diagram of a signal combining part in a transmitter station according to the present invention, which is a part of the IF-exciter IF1. In addition to the video signal vs1, audio signals as11, as12, and as13 are provided to the combining part. Alternatively, quadrature data signals I and Q can be provided to the combining part, the data signals having a bit-rate between 0-40 Mbit/s. The video signal vs1 is processed in a way known per se, in a first analog processing block 80 amplication and filtering being done, and in a second analog processing block clamping and pre-emphasis and being done inter alia. Various audio signals can be FM modulated onto an auxiliary carrier, such as the audio signals as11 and as12, which are FM-modulated by means of FM-modulators 82 and 83. Also a digital audio signal can be provided for, such as the digital audio signal as13 modulated by means of a so-called NICAM-modulator 84 (Near Instantaneous Companded Audio Modulation). At least one of the audio signals as11, as12, and as13, and the video signal vs1 are combined in a combining unit 85 of which an output signal is fed to an adding unit 86. Also an output signal from a PLL (Phase Locked Loop) low pass filter 87 is supplied to the adding unit 86. An output signal of the adding unit 86 is coupled to a VCO (Voltage Controlled Oscillator) 88 so as to obtain a modulated audi/video signal at 479.75 MHz. To this end, also a phase detector 89 is provided, of which inputs are coupled to an output of the VCO 88 and a crystal oscillator 90. Alternatively, for the sake of data transmission, the I and Q data signals are provided to a QPSK-modulator (Quadrature Phase Shift Keying) 91, an input of which is coupled to a 70 MHz oscillator 92. An output of the QPSK-modulator 91 is coupled to an input of a mixer 93 of which a further input is coupled to a 409.75 MHz oscillator 94 so as to obtain a 479.75 MHz intermediate data signal which is fed to an amplifier 95. Alternatively, an 479.75 MHz audio/video signal or a 479.75 data signal, being output signals of the VCO 88 or the amplifier 95 are fed to an high frequency switch 96.

Fig. 9 shows an electrical diagram of receiver stations R1 to R8 in the point-to-multipoint cellular television transmission system 1 according to the present invention. The receiver station R1 comprises the directional antenna RA1 having an aperture angle of a fwe degrees. A received signal is filtered by means of an image rejection filter 100, and thereafter fed to a mixer 101 to which also a local oscillator signal is fed from a local oscillator 102 generating a 9.5 GHz signal, when receiving a low band signal in the

40.5-41.5 GHz wave band and generating a 9.833 GHz signal when receiving a high band signal in the 41.5-42.5 GHz wave band. An output signal of the oscillator 102 is first amplified by means of an amplifier 103, and then tripled by means of a frequency tripler 104 using a varactor diode, before being fed to the mixer 101. An output signal of the mixer 101 is fed to a standard Low Noise Converter 105, such as applied for Satellite TV. Such a Low Noise Converter can be a Philips type SC 813/15 which is available on the market. By using a standard low noise converter, costs are reduced and the noise figure of the overall receiver is improved. The LNC 105 comprises an amplifier 106, a mixer 107, and an amplifier 108 of which an output provides a 950-2000 MHz signal which is fed to a standard domestic indoor unit as used for satellite reception (not shown). To the mixer 107 a signal from a local oscillator 109 if fed via an amplifier 110. For a more detailed description of the receiver R1 referred is to a Patent Application of the same Applicant, No. .... (PHN ......). The receiver station R1 can have adjustable attenuating means for attenuating the received signal, so as to adapt the receiver station R1 to a variable distance to the transmitter station T1 in a cell. Such an adjustment can be done with instalation of the receiver station R1. The adjustable attenuator means can be an attenuator (not shown), coupled to the directional receiving antenna RA1.

Fig. 10 schematically shows an in-house receiver station R1 according to the present invention. In contrast to the outdoor/indoor receiver station R1 as described in Fig. 9, the receiver station R1 can be an entirely indoor station to be placed behind a window of a building, or the like. Then, the receiver station R1 may be comprised in a casing csr on top of which a parabolic mirror mir is mounted, as an antenna, which can simply be an aluminium mirror. A received signal rsg is reflected by the parabolic mirror mir via an aperture ap to a converter con as described in Fig. 9. Via a satellite receiver like unit sat, which is coupled to the converter con, standard TV signals are fed to a TV receiver (not shown).

CLAIMS:

1. A point-to-multipoint cellular television transmission system (1) including at least two cells, each provided with a relatively low-power transmitter station (T1, ..., T19) for cell-wise transmission of at least one television signal in a cell (C1, ..., C19) of the cellular system (1) in which cells are adjacent to at least one other cell of the cellular system, and in which the transmitter stations (T1, ..., T19) transmit, at least in part, the same television signals in a microwave band, the system (1) further including a plurality of receiver stations (R1, ..., R8) comprising a directional receiving antenna (RA1, ..., RA8) for receiving a television signal from one of the transmitter stations (T1, ..., T19, characterized in that each transmitter station (T1, ..., T19) is located at a circumference (CF) of its cell (C1, ..., C19) of the cellular system (1), and is provided with one directional transmitting antenna (TA1, ..., TA7) for substantially radiating at least one television signal into its cell (C1, ..., C19).

2. A point-to-multipoint cellular television transmission system (1) according to claim 1, wherein the transmitting antennas (TA1, ..., TA7) generally transmit along a main geographical axis (ax) of the system (1).

3. A point-to-multipoint cellular television transmission system (1) according to claim 1, comprising two sub-systems, in each of which the transmitting antennas generally transmit along a geographical axis, the axes being non-coinciding.

4. A point-to-multipoint cellular television transmission system (1) according to claim 3, wherein the axes are substantially perpendicular to each other.

5. A point-to-multipoint cellular television transmission system (1) according to claims 1, 2, 3 or 4, wherein the transmitter stations (T1, ..., T19) comprise a plurality of independently operating transmitters each transmitting on a different, relatively narrowband, channel, the transmitters each being coupled to a radiator (TA1a, TA1b, ..., TA1i).

6. A point-to-multipoint cellular television transmission system (1) according to claim 5, wherein the television signals are compressed digital signals (MPEG), and at least two compressed signals are transmitted per narrowband channel.

7. A point-to-multipoint cellular television transmission system (1) according to claims 5 or 6, wherein the radiators (TA1a, TA1b, ..., TA1i) per transmitter station (T1,

..., T19) are directed into substantially the same direction (d).

8. A point-to-multipoint cellular television transmission system (1) according to any one of the claims 1 to 7, wherein the cells (C1, ..., C19) of the cellular system (1) form an array of cells, and the polarization of the signals, in a given channel and transmitted by the transmitter stations allocated to the cells, is different in adjacent cells.

9. A point-to-multipoint cellular television transmission system (1) according to any one of the claims 1 to 8, wherein the microwave band is split into at least two frequency sets (40.5-41.5 GHz; 41.5-42.5 GHz), and per transmitter station (T1, ..., T19) channel groups are interleaved according to the frequency sets.

10. A point-to-multipoint cellular television transmission system (1) according to claims 8 or 9, wherein radiators of odd numbered channels are polarized according to a first polarization, and radiators of even numbered channels are polarized according to a second polarization.

11. A point-to-multipoint cellular television transmission system (1) according to any one of the claims 1 to 10, wherein the cells partly overlap each other.

12. A point-to-multipoint cellular television transmission system according to any one of the claims 1 to 11, wherein large signal shadows in the system (1) are covered by auxiliary transmitter stations (RS), which are coupled to a main transmitter station (TA1) in a cell (C1).

13. A point-to-multipoint cellular television transmission system (1) according to any one of the claims 1 to 11, wherein small signal shadows in the system (1) are covered by cabling from a receiver station (R8), which is shared by a plurality of subscribers (S1, S2).

14. A point-to-multipoint cellular television transmission system according to any one of the claims 1 to 13, wherein the directional transmitting antenna is directed in such an angle with respect to a terrestial ground level in a propagation direction of a radiated beam that in a straight line the beam touches the ground level at a predetermined distance, preferably between 5 and 6 kilometers from the transmitter station.

15. A point-to-multipoint cellular television transmission system according to any one of the claims 1 to 14, wherein an aperture angle of the transmitting antenna is between 50 and 70 degrees.

16. A point-to-multipoint cellular television transmission system according to any one of the claims 1 to 15, wherein the microwave band is above 27.5 GHz.

17. A point-to-multipoint cellular television transmission system according to

claim 16, wherein the microwave band is between 40.5 and 42.5 GHz.

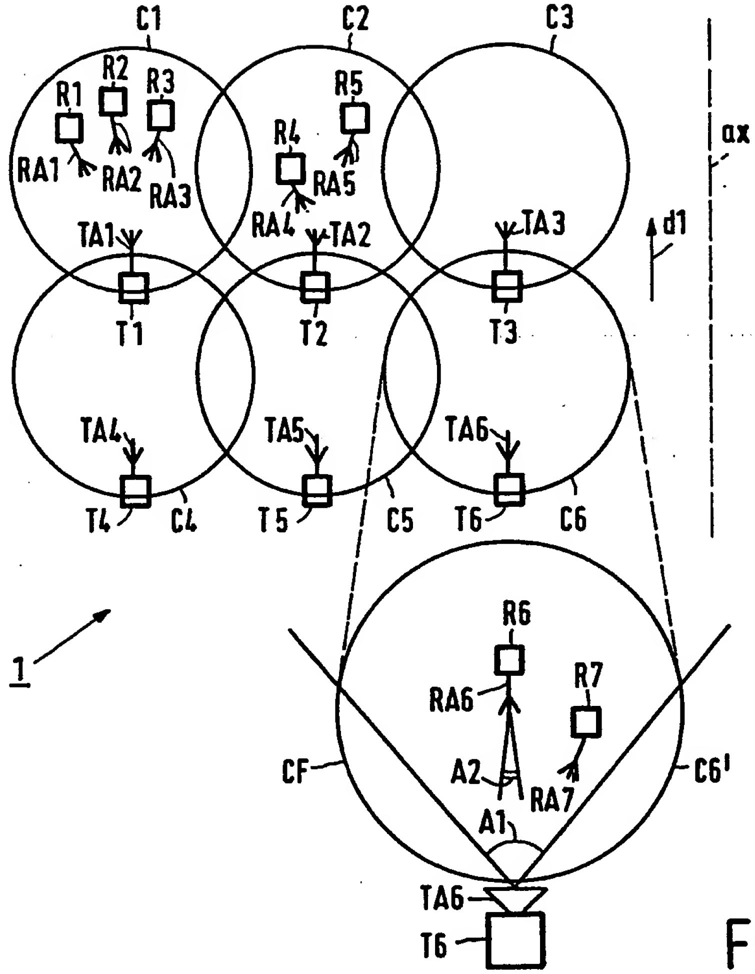

C1
C2
C3
R1
R2
R3
R4
R5
RA1
RA2
RA3
RA4
RA5
TA1
TA2
TA3
ax
d1
T1
T2
T3
TA4
TA5
TA6
T4
C4
T5
C5
T6
C6
1
R6
RA6
R7
CF
A2
RA7
C6'
A1
TA6
T6

FIG.1

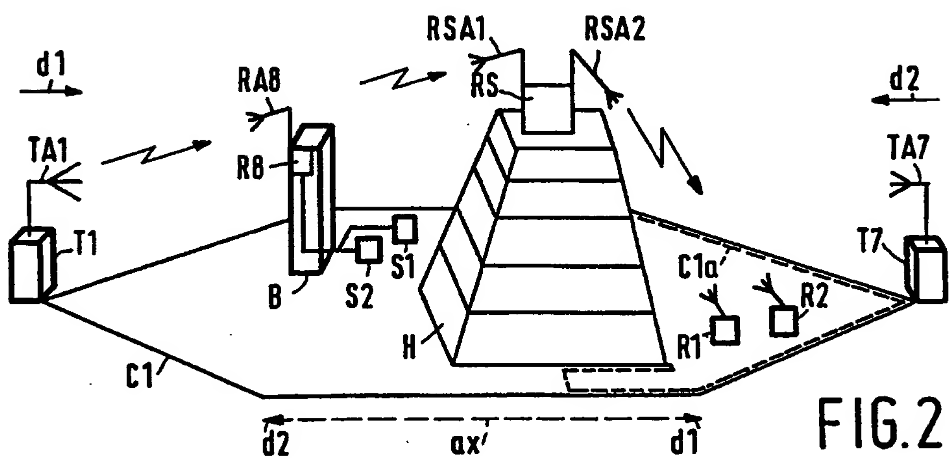

RSA1
RSA2
d1
RA8
RS
d2
TA1
R8
TA7
T1
S1
T7
C1a'
B
S2
R2
H
R1
C1
d2
ax'
d1

FIG.2

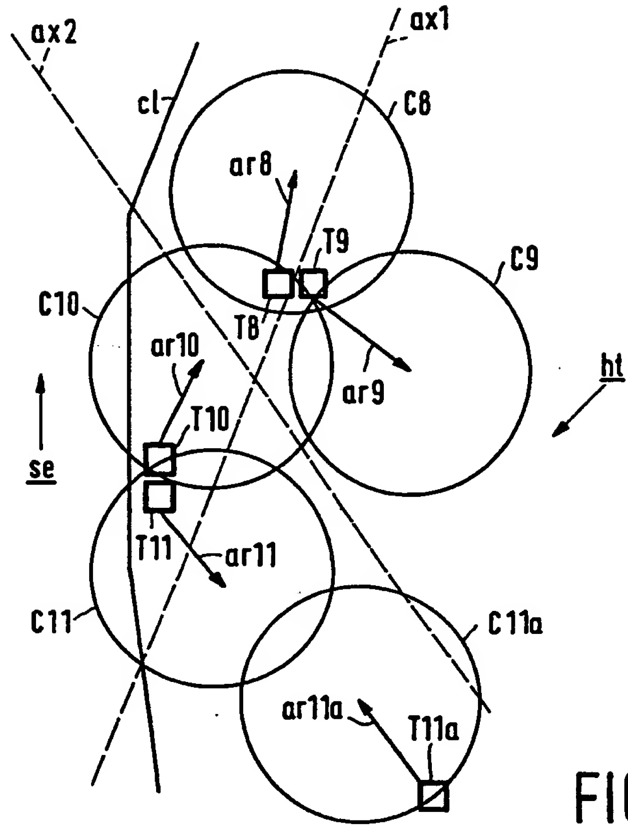

ax2
ax1
cl
C8
ar8
T9
C9
C10
T8
ar10
ar9
ht
T10
se
T11
ar11
C11
C11a
ar11a
T11a

FIG.3

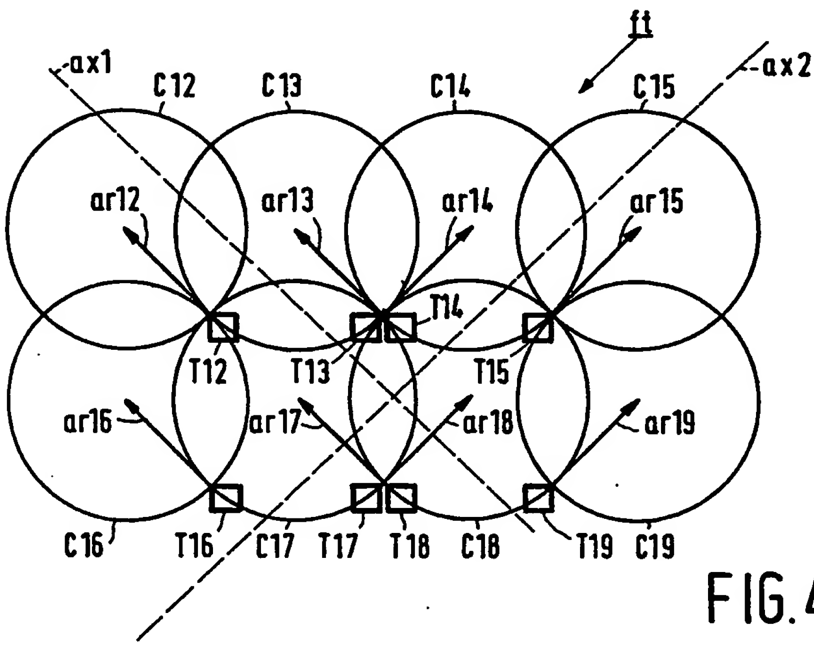

ft
ax1
ax2
C12
C13
C14
C15
ar12
ar13
ar14
ar15
T14
T12
T13
T15
ar16
ar17
ar18
ar19
C16
T16
C17
T17
T18
C18
T19
C19

FIG.4

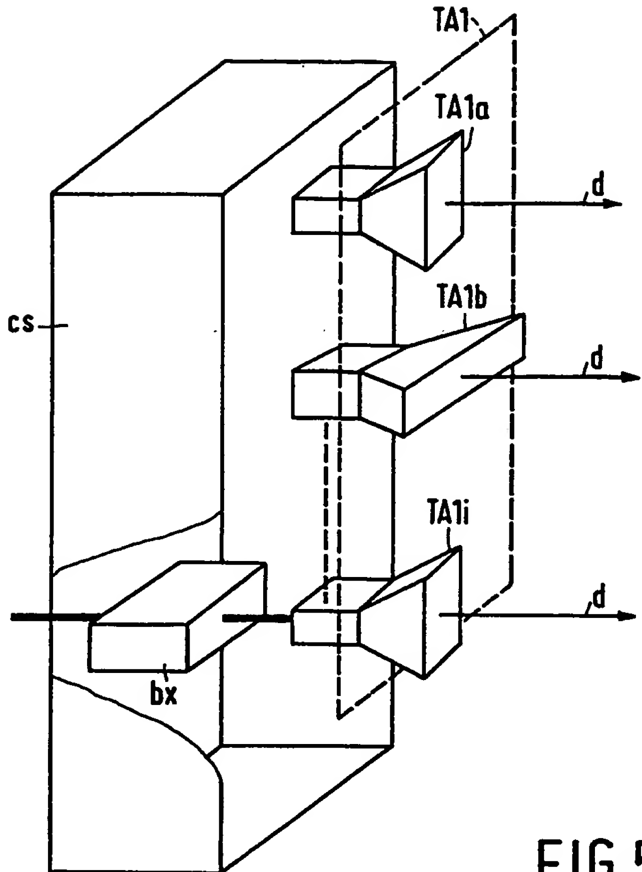

TA1
TA1a
d
TA1b
cs
d
TA1i
d
bx

FIG.5

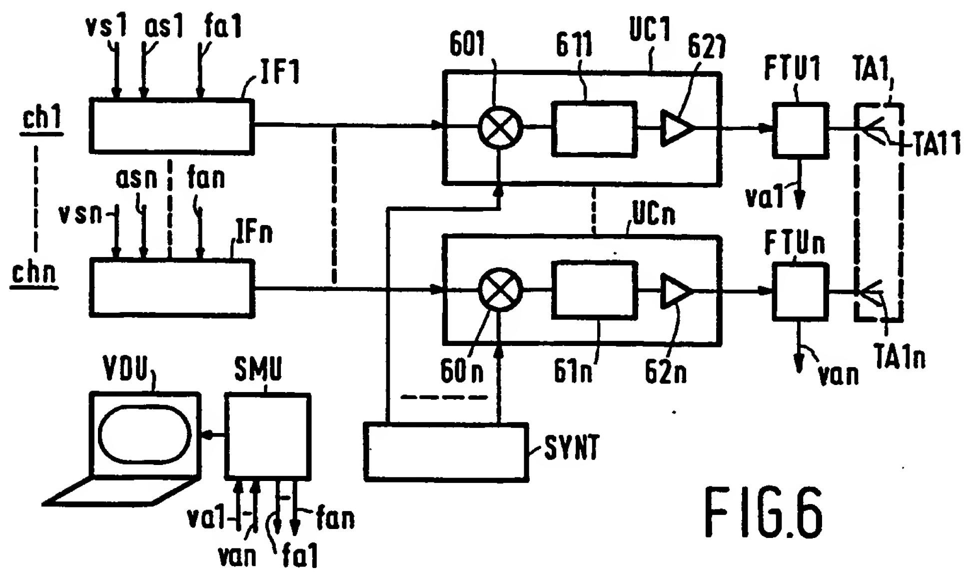
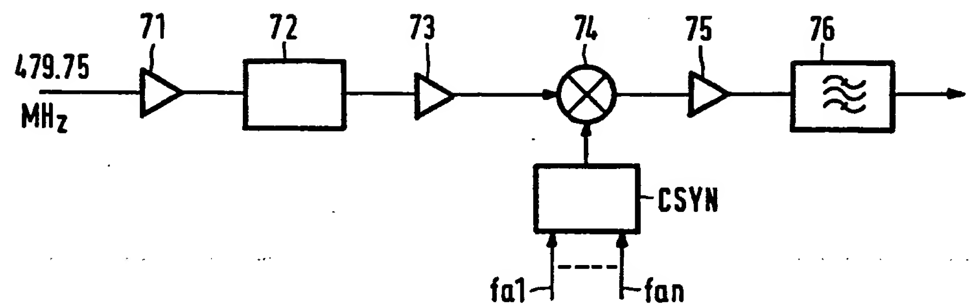
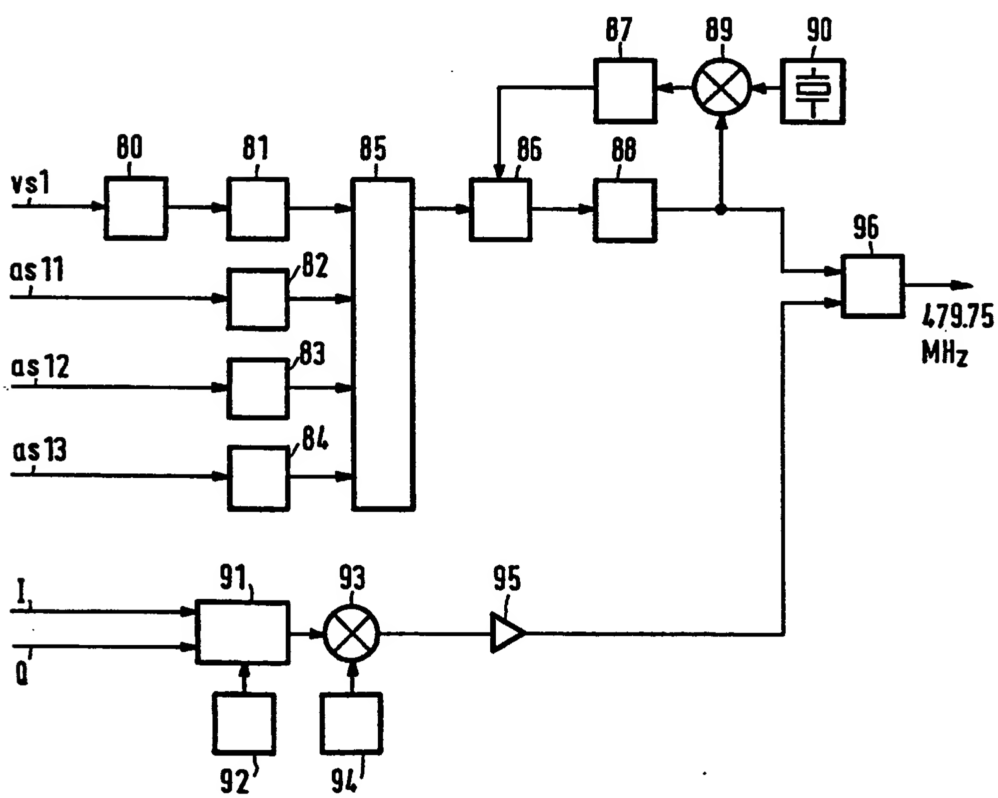

vs1 as1 fa1
IF1
ch1
asn fan
vsn
IFn
chn
601 611 UC1 621
UCn
60n 61n 62n
FTU1
TA1
TA11
va1
FTUn
van
TA1n
VDU
SMU
va1
van
fa1
fan
SYNT

FIG.6



71
72
73
74
75
76
479.75 MHz
CSYN
fa1
fan

FIG.7



87
89
90
80
81
85
86
88
96
vs1
as11
82
as12
83
as13
84
479.75 MHz
I
Q
91
93
95
92
94

FIG.8

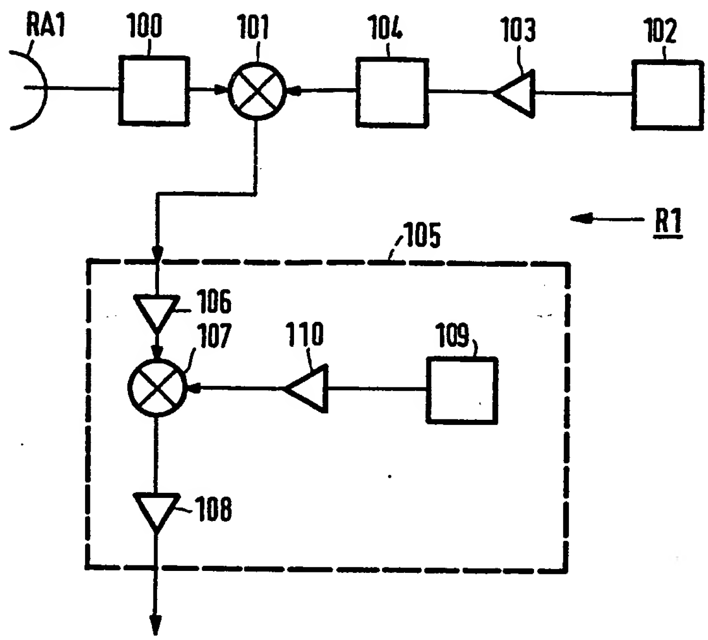

RA1
100
101
104
103
102
R1
105
106
107
110
109
108

FIG.9

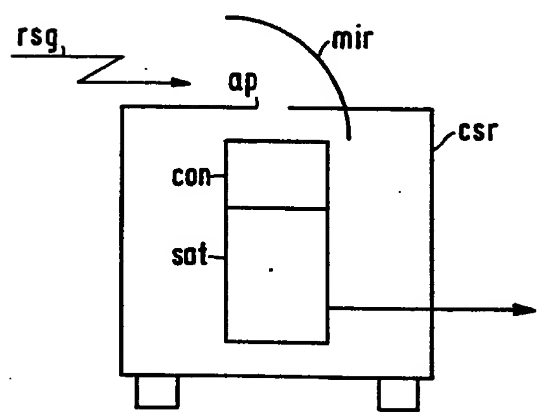

rsg
mir
ap
csr
con
sat

FIG.10